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SOME PYRENOMYCETES OF BERMUDA[1]

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(WITH PLATES 10 AND 11)

The pyrenomycetes of Bermuda have been but little studied. Berkeley (1), accompanying the Challenger Expedition, collected only four species, while Seaver reports only thirty-three (24). Other small collections were made by Farlow, Dodge, and perhaps other mycologists, but no published records of these have been found. In all cases, however, the collectors having remained for only short periods, the forms found were few in number.

The most extensive collections were made by Whetzel in 1921–22. His presence in the island for a whole year enabled him to secure a large number of species. The variety of forms with notes regarding their host range and frequence in different seasons is sufficient to give a very nearly true conception of the fungous flora of Bermuda.

The unidentified pyrenomycetes in the collection have served as the basis for the present paper. Three new species are here described. One, *Endothia Coccolobii,* which occurs rather extensively along the seashore, may have been collected before, but not described by the previous collectors, probably on account of their failure to detect its perfect stage, which is much more limited in its occurrence than the pycnidial stage. The second species described is *Anthostomella Rhizophorae,* a very peculiar form on account of the unusual shape of its ascospores. The last is *Euty-*

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pella linearis, which resembles *E. Bambusina* in habit and with which it can easily be mistaken.

In Bermuda some of the common North American species of *Hypoxylon* are represented, but are less common, while some of the rare North American Nectriaceae are found in abundance. Among these, *Ophionectria cylindrotheca* Seaver is perhaps the most common form.

The system of classification used in the present paper is that of Seaver (24) for the Hypocreales and that of Lindau (20) for the Sphaeriales. Britton's Flora of Bermuda was used as a guide for the names of the hosts, and Ridgway's Color Standards and Nomenclature for names of colors.

The writer wishes to express his thanks to Professor H. H. Whetzel, of the Department of Plant Pathology, Cornell University, for the courtesy of placing at his disposal a portion of his collections and field notebook; to Professor H. M. Fitzpatrick for supervising the work, for valuable suggestions, and for the revision and correction of the manuscript; and finally to Mr. W. R. Fisher for the care taken in making the photographs which illustrate this paper.

HYPOCREALES

NECTRIACEAE

NECTRIA Fries

NECTRIA PEZIZA (Tode) Fries, Summa Veg. Scand. 388. 1849.

MATERIAL EXAMINED: On fallen petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 8, 1922, H. H. Whetzel, Bermuda Fungi *74*.

Compared with: Rav. Fungi Am. *647* (Cornell Univ. Pl. Path. Herb. *10903*).

CALONECTRIA de Not.

CALONECTRIA ERUBESCENS (Roberge) Sacc. Syll. Fung. 2: 545. 1883.

Perithecia, when young, clothed with tortuous, cream-buff, distantly septate, minutely verrucose mycelial threads 2.5–3 μ thick, which are more or less evanescent in age.

In a recent discussion of the genus *Calonectria*, Weese (33) states that the form described by Seaver (22) as *Calonectria erubescens* (Roberge) Sacc. is not that species, but probably *C. tubaroensis* Rehm, which is identical with *C. gurapiensis* Speg. and *C. leucophaes* Rehm. According to Weese, Seaver's material is identical with a specimen identified by Ellis, Plants of Florida *1955*, and differs from *C. erubescens*, which does not occur on remains of *Meliola* and possesses characters quite distinct from the American form. It is singular that Ellis made this misdetermination, for in the description of *C. erubescens* in N. Am. Pyren., Ellis and Everhart call attention to the fact that *C. leucorrhodina* (Mont.) Speg. "scarcely differs from this (*C. erubescens*) except in its epiphyllous growth." Since this character has no significance inasmuch as both forms are saprophytic, Ellis and Everhart's conception of the species was exactly the same as that of Weese, who states that no difference between the two can be found.

MATERIAL EXAMINED: On rotten petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 29, 1922, H. H. Whetzel, Bermuda Fungi *73;* on inflorescence of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 8, 1922, Cornell Univ. Pl. Path. Herb. *11911*.

OPHIONECTRIA Sacc.

OPHIONECTRIA CYLINDROTHECA Seaver, Mycologia 1: 70. 1909.

"This is the most abundant nectria found. The perithecia are white, barrel-shaped, and very minute; they never occur in clusters, but are gregarious, covering large areas on the underside of rotten petioles of *Sabal Blackburnianum* Glaz. in very moist places in Paget Swamp" (from Professor H. H. Whetzel's field notes).

MATERIAL EXAMINED: On rotten petioles and leaves of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 16, 1922, Cornell Univ. Pl. Path. Herb. *11912*.

CREONECTRIA Seaver

CREONECTRIA OCHROLEUCA Seaver, Mycologia 1: 190. 1909.

Seaver states that the perithecia are 200–300 μ in diam., but we have found in both of the specimens examined that they measure 160–240 μ in diam.

MATERIAL EXAMINED: On rotten petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 29, 1922, Cornell Univ. Pl. Path. Herb. *11913*.

Compared with: H. M. Fitzpatrick's Herb. *1751* (also Cornell Univ. Pl. Path. Herb. *4046*).

SPHAERIALES

CHAETOMIACEAE

CHAETOMIUM Kunze

CHAETOMIUM GLOBOSUM Kunze, Myc. Hefte 1: 15, 16. *fig. 9 a–d.* 1817.

Spores elliptic, 12–17 x 7.5–9 μ, with ends acute to slightly apiculate.

Except for the spore measurements, the material examined resembles closely *Chaetomium Fieberi* Corda (as pictured in Icones Fung. 1: 24, *pl. 7, fig. 293C*), which Chivers (5) considers the same as *Chaetomium globosum* Kunze, because of their great similarity and on the ground that Corda was probably dealing with different stages of the same plant when he described several species of *Chaetomium* as distinct from *C. globosum* Kunze.

MATERIAL EXAMINED: On fallen leaves of *Sabal Blackburnianum* Glaz., Paget Marsh; Jan. 8, 1922, Cornell Univ. Pl. Path. Herb. *11895*.

Compared with: Cornell Univ. Pl. Path. Herb. *12089* (determined by A. H. Chivers).

SORDARIACEAE

PLEURAGE Griff.

PLEURAGE FIMISEDA (Ces. & de Not.) D. Griff. Mem. Torrey Club 11: 69–70, *pl. 8, fig. 1–5.* 1901.

MATERIAL EXAMINED: On cow dung, Paget Marsh, Jan. 1922, Cornell Univ. Pl. Path. Herb. *11909*.

SPHAERIACEAE

ROSELLINIA Ces. & de Not.

ROSELLINIA BREENSIS Starbäck Ark. Bot. 5^7: 17. 1905.

MATERIAL EXAMINED: On rotten sticks, Knutsford Paget, Feb. 20, 1922, H. H. Whetzel, Bermuda Fungi *75*.

Compared with: *type*, Exp. suec. in reg. Chaco-Andinis Fungi *105*.

ROSELLINIA DIDERMA (Schw.) E. & E. N. Am. Pyren. 175. 1892.

MATERIAL EXAMINED: On fallen petioles of palm, Fruitland, Aug. 1, 1921, Cornell Univ. Pl. Path. Herb. *11922*.

ROSELLINIA COCOES P. Henn. Hedwigia **47**: 256. 1908.

Although the pruinose character of the perithecia is somewhat lacking, there seems to be no doubt that the material examined is the above species. We have also examined Sydow's Fungi Exot. *183* and have found that our material answers the description much more closely.

MATERIAL EXAMINED: On fallen petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Aug. 18, 1921, H. H. Whetzel, Bermuda Fungi *110*.

Compared with: Sydow, Fungi Exot. *183* (Cornell Univ. Pl. Path. Herb.).

AMPHISPHAERIACEAE

MELOMASTIA Nitschke

MELOMASTIA MASTOIDEA (Fries) Schroet.; Lindau, in E. & P. Nat. Pfl. **1**: 414. 1897.

Melomastia Friesii Nitschke, in Fuckel, Symb. Myc. I Nachtrag 18 (306). 1871.

MATERIAL EXAMINED: On decorticated branches of *Lantana involucrata* L. ?, Paget, Dec. 8, 1921, H. H. Whetzel, Bermuda Fungi *145*.

CLYPEOSPHAERIACEAE

ANTHOSTOMELLA Sacc.

Anthostomella Rhizophorae sp. nov.

Perithecia epiphyllous, occurring in groups of 4–15 on circular spots 5–10 mm. in diam., globose, 0.5 mm. in diam., fleshy-membranous, soft, light-brown, papillate, with a circular ostiolum, clypeate; clypeus black, small, surrounding only the mouth of the perithecium; asci clavate, pedicellate, 135–192 x 40–60 μ, occasionally narrower, 8-spored; apex subacute; ascus wall disappearing before the spores are fully matured; paraphyses hyaline, simple, flexuous, nonseptate; spores subbiseriate to inordinate, when young, oblong, hyaline, at maturity, nonseptate, cylindric, 36–46 x 17–22 μ, brownish-olive to dark-grayish-olive; ends hemispheric, darker colored, nonapiculate to slightly so, contracted, the outer wall drawing away from the inner at the sides but not at the ends, partially collapsing with age, becoming wrinkled, but not falling away.

In all of the material examined only a single cluster of three pycnidia was observed associated with the perithecia. Whether this is the imperfect stage of the above species we are unable to state. Pycnidia sunken in the host tissue, small, erect-ellipsoid; pycnidial wall similar to that of the perithecium; pycnospores hyaline, nonseptate, ellipsoid, 4–4.5 x 2 μ, borne singly at the apices of simple, hyaline sterigmata.

The species is characterized by the very peculiar shape of the ascospore. As the spore matures, the inner wall thickens, and becomes darker colored at the ends. Later the whole spore gradually darkens, but because of changes which are probably chemical in nature the ends always remain darker than the rest of the spore and contract. As the spore undergoes these changes, the outer wall draws away from the inner, making it appear as if it were composed of an ellipsoid enclosed in a hollow cylinder with its ends projecting.

This species is closely related to *Anthostomella Rhizomorphae* (Kunze) Berl. & Vogl., from which, according to Berlese and Voglino's description (21; 11: 282), it differs chiefly in being epiphyllous, in the shape and size of the spores, and in not having a "rather hard perithecial wall."

Stevens determined as *A. Rhizomorphae* a fungus collected in

Porto Rico on *Rhizophora Mangle* L. We have examined his material (Cornell Univ. Pl. Path. Herb. *1276*) and have found that in certain points his description (30) does not agree with our observations. We have found the perithecia to average 540 μ in diam., but none of them reaches 600 μ, while Stevens gives the diameter as 700 μ; the spores are 34–43 x 17–22 μ instead of 24–40 x 14–17 μ as given by him, while the paraphyses are branched instead of simple.

Making the above corrections in Stevens's description and comparing the species, the outstanding differences between them are as follows:

A. Rhizomorphae (Kunze) Berl. & Vogl. (determined by Stevens), perithecia hypophyllous, equally distant from the upper and lower epidermis; spores oblong-ellipsoid to ellipsoid, with subacute ends; paraphyses branched, septate.

A. Rhizophorae sp. nov., perithecia epiphyllous, occupying the upper two thirds of the thickness of the leaf; spores cylindric, with hemispheric ends; paraphyses simple, nonseptate.

MATERIAL EXAMINED: Parasitic on leaves of *Rhizophora Mangle* L., Walsingham, Feb. 2, 1922, H. H. Whetzel, Bermuda Fungi *78*.

ANTHOSTOMELLA MINOR E. & E. N. Am. Pyren. 419. 1892.

Spores 7.5–8.5 x 3.3–3.7 μ.

Except for the somewhat wider spores as compared with 7–8 x 2.5–3 μ. given by Ellis and Everhart, the material examined corresponds exactly to the original description. The crustlike formation of the surface of the host, the connection of which with the perithecia could not be definitely ascertained by the above authors, was also observed in the material we have examined.

MATERIAL EXAMINED: On fallen petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Bermuda, Jan. 8, 1922, H. H. Whetzell, Bermuda Fungi *79*.

Compared with: Cornell Univ. Pl. Path. Herb. *7017* (determined by Ellis).

ANTHOSTOMELLA PALMICOLA (Auersw.) Rab.; Barbey Fl. Sard. Comp. 205 (revised by Franz v. Höhnel, Ann. Myc. 16: 70–71. 1918).

The ostiolum surrounded by a sporodochium-like outgrowth of mycelial threads 2–3 μ thick, flexuous, branched, faintly septate, salmon-orange (brownish-yellow under the microscope); otherwise as in von Höhnel's description (17). Although no conidia could be found either free or attached to the mycelial threads of the above structure, its connection with the perithecium itself is questionable without positive experiments. Nevertheless we are for the present inclined to think that it represents the imperfect stage of the species.

MATERIAL EXAMINED: On old petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 8, 1922, Cornell Univ. Pl. Path. Herb. *11897*.

VALSACEAE

EUTYPELLA Nitschke

Eutypella linearis sp. nov.

Stromata subgregarious, occasionally fusing, oblong to linear, 1–2.5 mm. long, 0.3–0.5 mm. wide, formed by the blackened epidermis above, light-brown within, with a straight dark line which is sometimes lacking, continuous with the flat bases of the perithecia; perithecia monostichous, in a single longitudinal row, black, carbonous, flask-shaped, 250–380 μ in diam., sometimes narrower by mutual compression, about 580 μ high, with a neck 200–250 μ long, cylindric to slightly conoid, deeply quadrisulcate, non- to half-exserted; asci clavate, 18–30 x 4.5–5.5 μ (p. sp.), long-pedicellate, 8-spored, with a tip 7–15 μ long, tapering upward, terminating in an obtuse to almost blunt apex; paraphysate; spores hyaline-lutescent, allantoid, 8–10 x 1.6–2.3 μ, 2-guttulate, inordinate.

The species is closely related to *E. Bambusina* Penz. & Sacc., which differs chiefly in having short nonsulcate necks.

MATERIAL EXAMINED: On fallen bamboos, Agr. Exp. Sta. Grounds, Nov. 1921, H. H. Whetzel, Bermuda Fungi *120*.

EUTYPELLA SABALINA (Cooke) E. & E. N. Am. Pyren. 497. 1892.

MATERIAL EXAMINED: On fallen petioles of *Sabal Blackburnianum* Glaz., Paget Marsh, Jan. 8, 1922, H. H. Whetzel, Bermuda

Fungi *76;* on fallen petioles of *Sabal Blackburnianum* Glaz., Oct. 30, 1921, H. H. Whetzel, Bermuda Fungi *116.*

DIATRYPACEAE

DIATRYPELLA Ces. & de Not.

DIATRYPELLA VERRUCIFORMIS SPEGAZZINIANA Sacc. Syll. Fung. 1: 201. 1882.

Spore and ascus measurements identical with the ones given by Berlese in Icones Fung. 3: 117. 1905.

From materials of four collections of the above species made by Professor H. H. Whetzel, in Bermuda, three different types of stroma distribution were observed: *178,* scattered to subgregarious; *80* and *81,* gregarious; *77,* densely gregarious. This diversity of habit is noteworthy in regard to the extent of variations of specific characters. We have examined these three forms carefully and have concluded that a single species is concerned.

MATERIAL EXAMINED: On inner surface of fallen pods of *Delonix regia* (Bojer) Raf., Pembroke Hall Paget, Mar. 1922, H. H. Whetzel, Bermuda Fungi *178;* on rotting decorticated wood of *Lagenaria Lagenaria* (L.) Cockerell, Tom More's Tree, Walsingham, Jan. 20, 1922, H. H. Whetzel, Bermuda Fungi *77;* on limbs of unknown plant, probably *Morella cerifera* (L.) Small, Paget Marsh, Jan. 1922, H. H. Whetzel, Bermuda Fungi *80;* on limbs of unknown plant, probably *Morella cerifera* (L.) Small, Devonshire Swamp, Jan. 1, 1922, H. H. Whetzel, Bermuda Fungi *81.*

MELOGRAMMATACEAE

ENDOTHIA Fries

Endothia Coccolobii sp. nov.

Stroma cortical, gregarious, circinate, hemispheric to conoid, erumpent, orange-rufous above, lighter colored within, 0.5–1 mm. in diam., partially covered by the epidermis; perithecia 2–5 in a stroma, deeply sunk, leathery-membranous, coffee-black,[2] globose to subglobose, 290–420 μ in diam., provided with a long, slender, straight neck which projects 0.5–0.6 mm. above the surface of the stroma, externally of the same color and structure as the stroma

[2] Not in Ridgway's Color Standards and Nomenclature.

with an acute apex which terminates in a black circular ostiolum. Asci oblong to subclavate, thicker in the middle, 30–40 x 4–6 μ (p. sp. 22–30 μ long), 8-spored, short-pedicellate, pedicel not over 8 μ long, with subacute apex, aparaphysate; spores hyaline, 1-septate, nonconstricted at septum, ovoid to fusoid, 5.5–8 x 1.8–2.7 μ, one or both ends acute, irregularly biseriate to obliquely uniseriate in the ascus with the ends strongly overlapping. Conidial stage belonging to the form genus *Endothiella* Sacc.; stroma producing pycnidia the same or similar to those producing perithecia, becoming black; pycnidia coffee-colored, formed by irregular cavities opening into a single black (externally and internally) conoid papilla which terminates in a circular ostiolum; sporophores slightly flexuous, hyaline, simple or only rarely branched at base, 12–20 μ long, occasionally much longer (up to 45 μ); pycnospores hyaline, bacilliform, 2–3 x 0.8–1 μ.

The above species differs from *E. longirostris* Earle, which is closely related, in the smaller size of the projecting beak of its perithecium, and from the other species of the genus in the smaller number of perithecia in a stroma and in lacking the gelatinous envelope of the spores.

MATERIAL EXAMINED: On fallen green fruits of *Coccolobis uvifera* (L.) Jacq., Grape Bay, Dec. 11, 1921, H. H. Whetzel, Bermuda Fungi *147*.

XYLARIACEAE

HYPOXYLON Bull.

HYPOXYLON COCCINEUM Bull.; E. & E. N. Am. Pyren. 629. 1892.

MATERIAL EXAMINED: On fallen limbs of *Amygdalus persica* L., Knutsford Paget, Nov. 1921, H. H. Whetzel, Bermuda Fungi *121*.

Compared with: E. & E. Fungi Columb. *733* (Cornell Univ. Pl. Path. Herb.); Cornell Univ. Pl. Path. Herb. *1326*.

HYPOXYLON RUBIGINOSUM (Pers.) Fries; E. & E. N. Am. Pyren. 645. 1892.

MATERIAL EXAMINED: On dead sticks and twigs, Knutsford Paget, Feb. 20, 1922, H. H. Whetzel, Bermuda Fungi *82*.

Compared with: E. & E. Fungi Columb. *838* and *1324* (Cornell Univ. Pl. Path. Herb.); Rav. Fungi Am. *654* and *741* (Cornell Univ. Pl. Path. Herb.).

HYPOXYLON MINUTUM Nitschke, Pyren. Germ. 54. 1867.

Sphaeria confluens Fries, Syst. Myc. **2**: 342. 1823. Not *S. confluens* Willd. 1787.

MATERIAL EXAMINED: On rotten sticks, Paynters Vale, Apr. 23, 1922, H. H. Whetzel, Bermuda Fungi *179*.

HYPOXYLON EFFUSUM Nitschke, Pyren. Germ. 48. 1867.

Perithecium 0.4 mm. in diam. and spores 6–7 x 2.5–3 μ.

MATERIAL EXAMINED: On log of *Persea Persea* (L.) Cockerell, Devonshire, Mar. 7, 1922, Cornell Univ. Pl. Path. Herb. *11900;* on old decorticated wood of *Melia Azedarach* L., Paget East, Oct. 1921, Cornell Univ. Pl. Path. Herb. *11901;* on fallen limbs of *Amygdalus persica* L., Whetzel's Garden, Paget, Nov. 1921, H. H. Whetzel, Bermuda Fungi *122*.

Compared with: E. & E. N. Am. Fungi *2114* (Cornell Univ. Pl. Path. Herb.).

XYLARIA Hill

XYLARIA ARISTATA Mont. Syll. Crypt. 205. 1856.

The species *Xylaria marasmoides* Berk. and *X. axifera* Mont. have been referred to by Theissen as synonymous to *X. aristata*. This is an error according to Lloyd (19), for these three forms, though related, are specifically distinct from each other. While *X. marasmoides* is evidently distinct from *X. axifera*, *X. aristata* can be readily distinguished from these two by the tubercular character of its fertile head.

MATERIAL EXAMINED: On fallen leaves of *Jasminum simplicifolium* Forst, Walsingham, Jan. 12, 1922, H. H. Whetzel, Bermuda Fungi *165*.

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EXPLANATION OF PLATES

PLATE 10

Fig. 1. *Eutypella linearis.* A section of the stalk of bamboo showing the stroma with three perithecia. × 60.

Fig. 2. *E. linearis.* Three mature spores. × 910.

Fig. 3. *E. linearis.* An ascus. × 400.

Fig. 4. *Anthostomella Rhizophorae.* A section of a leaf showing the perithecium. × 60.

Fig. 5. *A. Rhizophorae.* An ascus with immature spores and paraphyses. × 400.

Fig. 6. *A. Rhizophorae.* A fully mature spore. × 400.

Fig. 7, 8, 9. *A. Rhizophorae.* Three spores at different stages of maturity, as seen in longitudinal sections. × 400.

Fig. 10. *Calonectria erubescens.* A mature ascus. × 910.

Fig. 11. *C. erubescens.* Three spores at different stages of maturity. × 910.

Fig. 12. *C. erubescens.* A portion of the mycelial threads which radiate from the perithecium showing the verrucose character. × 910.

Fig. 13. *Endothia Coccolobii.* An ascus. × 910.

Fig. 14. *E. Coccolobii.* Three mature spores. × 910.

PLATE 11

Fig. 15. *E. Coccolobii.* A section of the cortex of a fruit showing the stroma with two perithecia. × 65. The long beaks of the perithecia are not shown here.

Fig. 16. *E. Coccolobii.* Free portion of the beak of a perithecium showing the stromatic structure of the outer layer. × 90.

Fig. 17. *E. Coccolobii.* A section of the cortex of a fruit showing a stroma with the pycnidial cavities opening into a single, black, homogeneous, short beak. × 65.

Fig. 18. *Anthostomella Rhizophorae.* Portion of the upper surface of a leaf showing the clypei of the perithecia. × 8.

Fig. 19. *A. Rhizophorae.* A group of spores at different stages of maturity. × 330.

Fig. 20. *A. palmicola.* Section of a petiole showing a perithecium with the sporodochiumlike structure at the apex. × 65.

Fig. 21. *Eutypella linearis.* Surface of the stalk of bamboo showing the stromata. × 8. The photograph taken near the node: the stromata are not typically elongate to linear here.

Fig. 22. *Chaetomium globosum.* A group of spores. × 330.

LIFE HISTORIES AND UNDESCRIBED GENERA AND SPECIES OF FUNGI

C. L. Shear

(With Plates 12 and 13)

It may not be wholly inappropriate to preface this article with something of an apology for perpetrating more names and descriptions of fungi on a long suffering mycological and pathological public. To paraphrase the oft-quoted saying about books: Of the *naming of species* there is no end!

The chief extenuating circumstance I can offer in this case is that after much search of herbaria and literature, no descriptions have been found which seem to apply to the fungi considered here, and since some of these organisms have forced themselves upon us by causing disease or decay in some of the plant products which we are supposed to help guard and protect, and as we are called upon to discuss them in their pathological and morphological or other aspects, it seems necessary to have names to apply to them. Someone may tomorrow find that one or more of these so-called "new species" has already been described. If so, we repeat our apologies, and gladly accept the previous name. The essential thing is that the organisms be represented in herbaria by good specimens and be so described or illustrated that they can in the future be identified with a reasonable degree of certainty. Our successors with their advanced knowledge may find, however, that we have accomplished our aim in this respect, but little, if any, better than our predecessors, most of whom presumably utilized the knowledge and facilities available to them without meeting present-day requirements.

Schizoparme[1] gen. nov.

I. *Perithecia* separate, embedded, submembranous to membranous, bearing about the ostiole and upper half a pseudoparenchymatous epistroma which ruptures the surface of the host

[1] From Greek *schizo*, to divide or split, and *parme*, a small shield.

and splits radially, exposing the ostiole; paraphyses none; ascospores hyaline or yellowish, nonseptate.

II. *Pycnia* very similar in character and appearance to the perithecia, having the same form of epistroma which ruptures in the same manner; spores hyaline, or pale-yellowish in mass, nonseptate, borne on a pulvinus at the base of the pycnium.

III. *Conidia* unknown or wanting.

Type: S. straminea.

Schizoparme straminea sp. nov.

I. *Perithecia* scattered or gregarious, embedded or erumpent, frequently associated with the pycnia, submembranous to membranous, 100–500 μ in diameter, surmounted by a circumostiolar

FIG. 1. *Schizoparme straminea.* Vertical view of a perithecium, showing the quadrifid, discoid epistroma on an old rose leaf.

epistroma same as in the pycnia, usually collapsing when dry and the epistroma splitting radially, thus exposing the papillate ostiole; asci cylindric or elongate-elliptic, sessile or very short-stipitate, 40–50 x 8–10 μ, with an apparent thickening at the apex and a slight protuberance projecting downward; paraphyses wanting; ascospores hyaline or pale-yellowish when old, nonseptate, elliptic, fre-

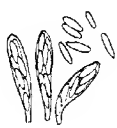


FIG. 2. *Schizoparme straminea.* Asci and ascospores. X 420.

quently slightly inequilateral or curved, 11–13 x 3–4 μ; apparently surrounded by a thin mucilaginous envelope which sometimes causes the appearance of a slight appendage at the end of the spore.

II. *Pycnia* scattered or gregarious, embedded or erumpent, submembranous to membranous, collapsing when mature and dry, pro-

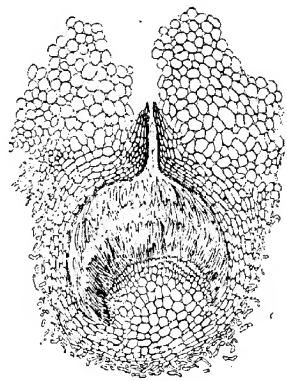


FIG. 3. *Schizoparme straminea.* Median vertical section of a pycnium from strawberry fruit, showing the loose tissue of the epistroma about the upper portion of the pycnium.

vided above with a straw-colored epistroma about the apex which ruptures radially, exposing the papilliform ostiole; globose or subglobose, 100–350 μ in diameter; sporophores simple, tapering, 10–15 μ long, borne on a pulvinus at the base; pycnospores, elongate-elliptic, straight or slightly irregular and inequilateral, hyaline, becoming pale-greenish-yellow in mass, nonseptate, 15–20 x 3–4 μ.

Type: C. L. Shear 3568, on old fallen leaves of *Rosa rugosa prostrata*, rose garden, Arlington Farm, Va., September 6, 1920; also slide of same number from the same specimen.

First found in its pycnial form by Dr. B. O. Dodge on strawberries from Norfolk, Va.; also one or both stages on dead leaves of strawberry, *Castanea, Prunus, Quercus, Rhus, Rubus, Salix*, and *Vitis* in Maryland and Virginia in the vicinity of Washington, and on *Eucalyptus*, Miami, Florida, from June to October, and on *Quercus* in Italy associated with *Sporonema quercicolum* C. Massalongo (*Sclerotiopsis concava* (Desm.) Shear & Dodge) on a part of the type specimen of that species kindly contributed by its author.

RELATIONSHIP

The pycnia resemble *Coniothyrium diplodiella* (Speg.) Sacc., so well described and illustrated by Istvanffi in his monograph, "Sur le rot livide." That has a similar development of fungous tissue about the ostiole and a pulvinus in the bottom of the pycnium. The perithecial form, said by Viala and Ravaz to belong to this *Coniothyrium*, was described by them as a new genus, *Charrinia*. According to their description this differs from *Schizoparme* in having paraphyses and 1–3-septate ascospores and lacking the perithecial epistroma. In general character of the perithecia and spores, *Schizoparme* seems related to some of the species described under *Physalospora*. *Coniothyrium diplodiella* is not, however, a true *Coniothyrium*, and the pycnial form of *Schizoparme* can not properly be referred to that form-genus, the type of which, as pointed out by von Höhnel, is *Leptothyrium pini* (Corda) Sacc. Much more work is necessary before any satisfactory disposition can be made of the various pycnial forms of the Ascomycetes. We are unable at present to refer the pycnial form of *Schizoparme* to any particular form-genus and do not consider it desirable to add another generic name to the great superfluity already existing.

CULTURES

As the small hyaline ascospores are difficult to isolate, most of the ascospore cultures were made from single asci which could be readily separated and isolated in poured plates. Over one hundred such single ascus cultures have been made. In all cases the characteristic pycnia were produced, but no perithecia were ever found, though cultures were kept on different media for a long time. The ascospores germinate in a few hours at ordinary room temperatures in summer. A thin, white, superficial, circular growth of hyphae is produced in a few days. This growth has a more or less lobed or broadly crenate margin. Pycnia are formed in concentric circles and begin to mature in five or six days. Cultures from pycnospores develop in the same manner, and produce the same characteristic pycnia. The pycnia in culture frequently become aggregated and more or less united in small groups. A detailed description and discussion of the development of the pycnia

has just been published by Dr. B. O. Dodge, Jour. Agr. Res. 23: 743. Apr. 25, 1923, to whom we wish to acknowledge our great indebtedness for assistance, especially in connection with the illustrations.

Fragosphaeria gen. nov.[2]

I. *Perithecia* colored, carbonaceous, brittle, astomous, sutured, dehiscing into numerous, more or less regular, polygonal segments at maturity.

III. *Conidial* form consisting of a thin, white, effuse growth of hyphae; fertile portions alternately branched, bearing hyaline non-septate spores on the more or less enlarged ends of the branches.

Fragosphaeria purpurea sp. nov.

I. *Perithecia* deep dark-purple, opaque, globose, carboneous, brittle, astomous, breaking into numerous, mostly pentagonal segments when old or crushed; asci subglobose, 4–6 μ in diam., held together in irregular compact globose masses, see fig. 4, by branch-

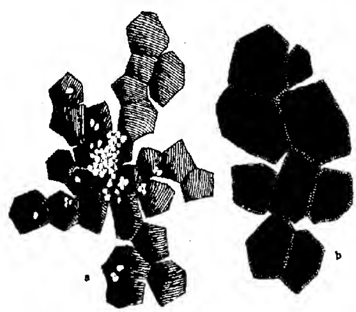


FIG. 4. *Fragosphaeria purpurea.* (a) Ruptured perithecium showing the segments into which the wall divides and the subglobose masses of ascospores. (b) Segments of a perithecial wall showing the sutures. Highly magnified.

ing stipes, soon becoming evanescent; paraphyses none; ascospores yellowish-brown in mass, flattened on one side or broadly bean-shaped, 2.25–2.75 x 1.5–2 μ. The ascospores tend to adhere in globose masses after the asci have disappeared.

II. *Pycnia* unknown.

III. *Conidial* form[3] thin, white, effuse, much branched; conidia

[2] From *fragor*, a breaking to pieces, and *sphaera*, a sphere.

[3] This seems referable to the genus *Rhinotrichum*.

formed on somewhat enlarged, elongated and roughened ends of the alternately branched fertile hyphae, oblong-elliptic, inequilateral or suballantoid, nonseptate, hyaline, 3–4 x 1–1.5 μ.

Type: Pure culture tube *4821* on corn meal agar. This fungus appeared in poured plates of *Pilacre petersii* gathered on a beech log near Chain Bridge, Va., September 19, 1920, and has since been kept in pure culture on different media.

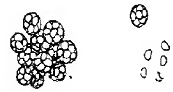


FIG. 5. *Fragosphaeria purpurea.* Asci and ascospores. × 800.

It seems to produce conidia and perithecia best on oatmeal paste to which 1 per cent glycerine has been added. It also fruits on corn meal agar with 1 per cent glycerine. It first forms a thin white growth of hyphae, which soon produces conidia, and the agar becomes dark-purple about the colony. In from ten days to two weeks the globose, dark-purple perithecia appear.

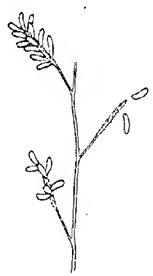


FIG. 6. *Fragosphaeria purpurea.* Conidiophores and conidia. × 800.

This genus is evidently closely related to such genera as *Pleuroascus, Magnusia,* and *Arachnomyces.* It differs, however, from these genera, as illustrated by Massee and Salmon in their paper on Coprophilous Fungi, Ann. Bot. **16**: 68–70, in being without appendages, or at least any of a definite character, and also in the mode of dehiscence of the perithecia. The spore characters are very similar, but the asci in those genera are not described as

occurring in masses united by branching stipes as is the case in *Fragosphaeria.*

Peridoxylon gen. nov.

Stroma fleshy to coriaceous; perithecia tough membranous, immersed in several series in the upper or distal portion of the stroma, the perithecial part of the stroma covered at first with a membranous or subcoriaceous peridium which ruptures irregularly breaking up into fragments and disappearing except for a border about the margin; asci 8-spored, spores dark-colored, nonseptate; paraphyses filiform, obscure.

Type: Hypoxylon petersii B. & C.

This species was first described by Berkeley and Curtis in 1869 as *Hypoxylon petersii,* from specimens collected by Judge Peters in Alabama. A fuller description was given by Ellis & Ev. Jour. Myc. 4: 39. 1888, from additional specimens collected by Morgan in Ohio and Kentucky. Their description agrees in all essential particulars with the specimens gathered by the writer on decaying oak branches in the woods at Arlington Cemetery, Virginia, August, 1922. Specimens have also been reported from Indiana. Aside from its dark-colored, nonseptate spores, this fungus bears little resemblance to *Hypoxylon,* and is evidently not congeneric with the other species of that genus. In character of stroma this genus is closely related to the Hypocreaceae, but there is no clear-cut line of demarcation between the Hypocreaceae and Xylariaceae. Entirely too much taxonomic significance has been given to the substance of the stroma in separating these two families. Why should the character of the tissue of the stroma be of any more taxonomic importance generally than is the character of the tissue in higher plants? As mycologists we are still apparently in many respects in what corresponds to the mediaeval stage in the development of our taxonomy.

The following genera of Pyrenomycetes having fleshy stromata and similar spores are more or less related to this genus.

Galziella. Berkeley described this in his paper on Fungi Brasiliensis, 1880 in the Proceedings of the Natural History Society of Copenhagen as having a subglobose, fleshy, bright-colored stroma and pale perithecia filled with gelatin. The single species, *G. vesiculosa,* was mentioned, but not described. Lloyd has attempted

to identify this, but we are inclined to agree with Moeller that the name should be discarded, as no ascomycete can be satisfactorily recognized without a description of the asci and ascospores. In any case there is no reason to suppose that our specimens belong here.

Sarcoxylon. Cooke, Grevillea **12**: 50. 1883, established this genus and described it as having a rather fleshy, pale or bright-colored, subglobose, pulvinate or depressed stroma; perithecia submembranous. No cuticle or peridium was mentioned. Two species, *S. compunctum* (Jungh.) and *S. lycogaloides* (B. & Br.), were referred to it. Neither species is described as having a peridium or perithecia in more than one series.

Penzigia. Saccardo, in Mycetes Malaccae 20. 1888, described this as having a subglobose, hemispheric, or pyriform stroma, radiate-fibrose within, black, crustaceous, smooth; perithecia covering the stroma, immersed. This is apparently related to *Daldinia*, but is said to differ in color and nonzonation of the stroma.

Thuemanella. Penz. & Sacc. Malpighia **11**: 518. 1897. The type of this genus is *T. javanica* Penz. & Sacc. It has a fleshy, subglobose, yellow stroma with perithecia embedded and scattered over the surface in an irregular single series. No peridium is mentioned and the illustration shows no suggestion of any. The author says this is related to *Sarcoxylon*, but the stroma is truly hypocreaceous and the texture not radiate.

Engleromyces. P. Henn. Engl. Jahrb. **28**: 327. 1900. This is described as having a globose, fleshy, soft, black stroma, nonzonate inside with perithecia pluro-stratose. The type is *E. Goetzii*, having a black rugulose-verrucose cortex, and soft-fleshy or cheesy inside. The stroma is at first covered with a superficial conidial layer. This differs from *Peridoxylon* in having the perithecia distributed over the whole stroma and lacking a peridium.

Entonaema and *Xylocrea.* Moell. Phyco. and Asco. Braz. 301–307. 1901. These are genera having fleshy stromata with perithecia in a single series and without a peridium.

It is clear from the descriptions and figures and from the specimens we have seen that *Engleromyces* is more nearly related to our fungus than any other genus we have found described. *Peri-*

doxylon differs, however, from that in having the perithecial layer restricted to the distal portion of the stroma and in being covered at first with a peridium. In fact, the presence of the peridial membrane is a most remarkable feature not found in any other known pyrenomycete, so far as we have been able to discover. The character and structure of the stroma is also very characteristic and different from most other Xylariaceae or Hypocreaceae. In its fresh condition the plant might at first glance be easily mistaken for the discomycete, *Sarcosoma rufa* (Schw.). The substance of the stroma, color, and general shape are very much the same. The first noticeable difference is the dark-colored surface of the perithecial layer, and upon closer examination, of course, the presence of the peridium forming the border about the margin after it has ruptured and the greater part disappeared.

The surface of the perithecial portion of the stroma when fresh looks as though covered with a thin film of India ink. This on microscopic examination proves to be a coating of the ascospores, which are expelled in large quantities and held together apparently by mucilaginous matter. This coating slowly dries, giving the surface a shining, deep smoky-black color. The stroma is fleshy-gelatinous when fresh, very elastic under pressure, shrinking much in drying and becoming at first coriaceous and finally quite hard. The inside of the stroma is chestnut-brown in section and somewhat lacunose, as shown in pl. 12, fig. 1; that is, there are various shaped, small cavities, some elongated and narrow. The peridium in our specimens had largely disappeared except for an irregular border; but from the large broken irregular fragments remaining attached near the margin of the stroma and on the ground it was very evident that it had at first entirely covered the perithecial portion. This peridium is 1–2 mm. thick and membranous or subcoriaceous. The stromata are mostly broadly conoid-truncate; outside rough from adhesion of the decaying wood of the substratum. The perithecia are very numerous, crowded and irregularly arranged in 5 or 6 series in the stroma, as shown in pl. 12, fig. 1. The perithecial walls are tough-membranous and slightly darker than the stromatic tissue. The spores are dark-blue-black in mass and concavo-convex or collapsed; as can readily be demon-

strated by rolling them over by pressure on the cover glass, ovoid to elliptic, 6–8 x 3.5–4 μ.

Among the usual Xylariaceae the only species which suggest a relation to this in stromatic character or arrangement of perithecia are *Nummularia lutea* A. & S., a European species which has the perithecia in several irregular series in a coriaceous yellow stroma, but without a peridium; and a species referred to *Hypoxylon* by Berkeley, *H. ovinum*, Grev. **11**: 129, 1883, which is described as hemispheric, dark-purple, hard, smooth, shining, dark within with perithecia black and stratose. This might belong to the same genus as *P. petersii* if it had a peridium, but none is mentioned, although even in dried specimens, if present, the remains should be evident about the margin of the distal portion.

Phyllostictina carpogena sp. nov.

Pycnia gregarious or somewhat scattered, erumpent, the upper half finally more or less exposed, globose, subglobose or pyriform, subcarboneous, black, usually with a papillate beak, ostiolate.

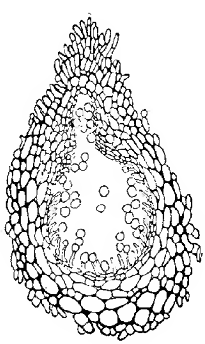


FIG. 7. *Phyllostictina carpogena.* Vertical section of a pycnium.

Spores globose or irregularly subglobose, continuous, hyaline or pale-yellowish in mass, smooth, 5–7.5 x 4.5–6 μ; sporophores pyriform or obclavate, 5–10 x 1.5–2.5 μ.

Type: B. O. Dodge 3701 on decaying Leucretia dewberry from Cameron, North Carolina, August 1919. Illustration, pl. 13, fig. 3, from section of the same, *3701*. Typical specimen also on dead

cane of the Leucretia dewberry, Jonesboro, North Carolina, April 1922, *B. O. Dodge 4030.*

This fungus is not uncommon on old dead dewberry vines in North Carolina and also in the vicinity of Washington, D. C., and has frequently been found in the Washington and New York markets, causing rot of dewberries grown in North Carolina.

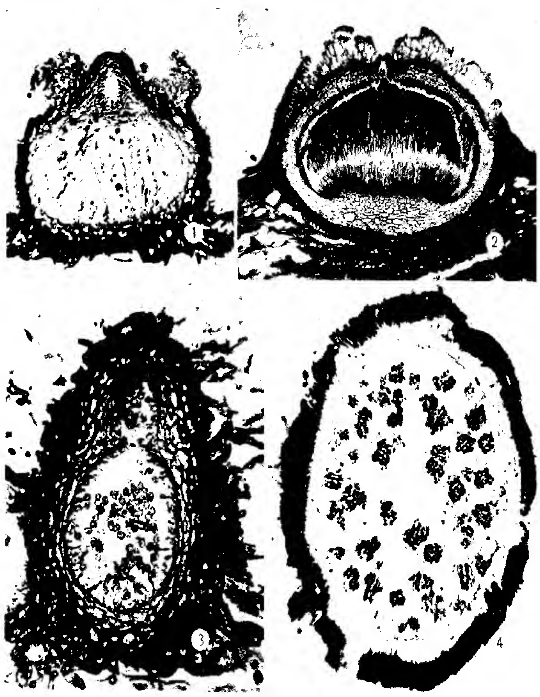
In mode of development and character of the pycnia and spores this form shows very close relationship to the pycnial stage of the black-rot fungus of the grape, *Guignardia bidwellii.* The distinctive features in the development of the pycnia have been studied by Dr. Dodge, who has just published a paper on the subject. There is little doubt in the mind of the writer that this is the pycnial stage in the life-history of a Guignardia. A perithecial form of the Guignardia type has been found on dead dewberry vines in the same locality, which agrees with the description of *Physalospora carpogena* Atk. Bull. Cornell Univ. 3: 8. 1897, found on old seeds of blackberries. We have not yet been able to get ascospore cultures of this, but hope to later.

This pycnial form is referred to the form-genus *Phyllostictina* Syd., 1916, the monotype of which, *P. murrayae* Syd., is discussed by von Höhnel, 1920, who shows its close relationship to the pycnial form of the common black-rot fungus on grape, *Guignardia bidwellii.*

The names *Phoma* and *Phyllosticta* have been applied to such a large number of miscellaneous and heterogeneous pycnial forms that they have lost all definite taxonomic significance they may ever have had and should either be anchored to a particular type species and restricted to forms congeneric with it or discarded.[4] *Phyllostictina* in the sense in which it is here used should be restricted in its application to the pycnial forms of the genus *Guig-*

[4] Seaver, 1922, N. Am. Fl. 6: 3, indicated the type of *Phyllosticta, P. Convallariae* Pers., but included in the genus a large number of forms having very different characters and life histories from the type. V. Höhnel, 1918, Ann. Myc. 16: 98–101, discussing *Phoma* of Fries, 1819, refers to the original monotype, *Sphaeria pustula* = *Hypospila pustula* of recent authors; but decides that the type should be *P. saligna* taken from Fries' later work, Syst. Myc. 1823, where that species happens to be given first. Adopting either of these species as the type would place the genus in the Pyrenomycetes instead of the Imperfecti.

PERICONXYLON PETERSII (BERK. & CURT.) SHEAR



Schizoparme straminea Shear

nardia, as applied to species congeneric with the common *G. bidwellii*. All the pycnia of this type so far investigated show histolysis of the pseudoparenchymatous tissue, which at first fills the pycnium, resulting in its containing at maturity much mucilaginous matter which envelops the spores and causes them to adhere in a more or less globose mass when they are expelled from the pycnium by crushing it. Of a similar character apparently is the granular appendage frequently found at the apex of the pycnospore. This is easily observed in **Phyllostictina vaccinii** comb. nov., the pycnial form of *Guignardia vaccinii* Shear.

Phyllosticta solitaria E. & E. is a good Phyllostictina, agreeing in every essential respect morphologically with *P. carpogena* and *P. bidwellii*, and probably has Guignardia as its ascogenous fructification. *P. congesta* Heald & Wolf also belongs here.

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EXPLANATION OF PLATES

PLATE 12

FIG. 1. *Peridoxylon petersii*. Median vertical section of a stroma showing the irregular series of perithecia and the lacunae in the stroma. Nat. size.

Fig. 2. *P. petersii*. Opposite view of same. Nat. size.

Fig. 3. *P. petersii*. Vertical view of a stroma showing the perithecial portion with the marginal remains of the peridium. Nat. size.

Fig. 4. *P. petersii*. Lateral view of compound stroma showing remains of the peridium. Nat. size.

PLATE 13

Fig. 1. *Schizoparme straminea*. Median vertical section of a perithecium from *Rhus copallina*, showing papilliform beak and remains of the epistroma. × 160.

Fig. 2. *S. straminea*. Median section of a pycnium from the same host, showing papilliform beak and remains of the epistroma. × 200.

Fig. 3. *Phyllostictina carpogena*. Section of a pycnium from fruit of dewberry. × 285.

Fig. 4. *Fragosphaeria purpurea*. Median section of a perithecium showing sutures in the perithecial wall and irregular masses of asci. × 100.

VARIETAL RESISTANCE AND SUSCEPTIBILITY OF SORGHUMS TO SPHACELOTHECA SORGHI (LINK) CLINTON AND SPHACELOTHECA CRUENTA (KÜHN) POTTER[1]

George M. Reed

(With Plates 14 and 15)

Very extensive investigations on the resistance and susceptibility of varieties of sorghum (*Holcus Sorghum* L.) to the covered kernel-smut (*Sphacelotheca Sorghi* (Link) Clinton) have been carried out.[2] Practically all of the varieties of sorghums, many of which were represented by a number of different strains obtained from various sources, were grown.

As a result of these investigations it was found that the strains and varieties of broom corn, kafir, shallu, and sorgo were quite susceptible to the covered kernel-smut, giving relatively high percentages of infection. Two varieties of durra, the common Brown and White durra, also proved highly susceptible. However, in recent years a number of introductions of White durra have been made and some of these have shown a high degree of resistance. The kaoliangs, as a group, were only moderately susceptible; a few varieties like Barchet, Blackhull, Manchu Brown, and Valley kaoliang gave relatively high percentages of infection; on the other hand, Dwarf Brown kaoliang has consistently proved to be resistant. All varieties and strains of milo and feterita have shown very marked freedom from infection. Several miscellaneous sorghums were also grown and some, for example, Schrock kafir and

[1] Brooklyn Botanic Garden Contributions No. 30.

[2] These results, which have been written up by the author in coöperation with Professor L. E. Melchers, are based upon experiments conducted at Columbia, Mo. (4 years); Manhattan, Kan. (6 years); Amarillo, Tex. (4 years); Arlington Experiment Farm, Va. (2 years); and Brooklyn, N. Y. (2 years). The manuscript has been submitted for publication as a Bulletin of the U. S. Dept. Agr.

Freed sorgo, were infected to a greater or less extent. Others, as Darso, Dwarf Hegari, Kafirita, and Sudan corn, gave negative results.

Observations on the head-smut (*Sorosporium Reilianum* (Kühn) McAlpine) of sorghum were also made at Amarillo, Texas, where soil infestation appears to be prevalent. No infections of broom corn, feterita, and milo were observed. A low percentage of infection occurred in several varieties of kafir and kaoliang, and somewhat higher percentages of infection in certain varieties of sorgo. However, only eight varieties of sorghum showed conspicuous susceptibility to the head-smut: Brown durra (*S. P. I. 17537*); White durra (*S. P. I. 17535*); Black Amber sorgo (*S. P. I. 32384*); Minnesoto Amber sorgo (*F. C. I. 01950*); Red Amber sorgo (*S. P. I. 1534* and *17548*); Coleman sorgo; Early Rose sorgo; and Schrock kafir.

Potter (27) and Kulkarni (20) have recorded some results with the loose kernel-smut (*Sphacelotheca cruenta* (Kühn) Potter). Potter reported that he was unable to infect milo with this smut, but with some other sorghums he obtained the following percentages of infection: Amber sorgo, 10.9 per cent; Freed sorgo, 5 per cent; broom corn, 6.9 per cent; kafir, 13.8 per cent; and kaoliang, 10.3 per cent.

Kulkarni (20) inoculated seed of Dwarf milo with the spores of both covered and loose smut and planted it at the Agricultural College Farm, Poona, India. Apparently the same lot of seed was inoculated with the spores of both smuts. He obtained a total of 645 heads, of which three were infected by *Sphacelotheca sorghi* (.47 per cent infection) and fifty by *S. cruenta* (7.8 per cent infection). The three plants infected by *S. Sorghi* may have been some other sorghum which was accidentally present in the plot. It is a question, however, whether the results with *S. cruenta* can be thus explained.

The writer has continued his investigations on the behavior of sorghum varieties to covered kernel-smut (*Sphacelotheca Sorghi* (Link) Clinton) and, in addition, has carried out a series of experiments with the loose kernel-smut (*S. cruenta* (Kühn) Potter).

Sphacelotheca Sorghi is a typical kernel-smut, the individual

ovaries of the flowers being involved and converted into false kernels, or smut balls. It is unquestionably the most widely distributed and destructive smut which attacks sorghums and is probably to be found wherever these plants are grown. It was first described, from a specimen collected in Egypt, by Link (23) in 1825. Since then it has been recorded by a large number of observers. Barber (2), Kulkarni (19), and Butler (10) note its prevalence in various parts of India, where it is a destructive disease of sorghums in the Madras Presidency, Bombay Presidency, the Central Provinces, and Burma. A large number of seed lots of Chinese kaoliangs have been imported into the United States and Ball (1) states that most of them were contaminated with the spores of this smut. This indicates its prevalence in those parts of China where kaoliangs are grown. Miura (25) mentions its occurrence in Manchuria; Bubák (6) and Thomas (31) in Mesopotamia; Busse (9) in Tanganyika Territory (formerly German East Africa); Snowden (30) in Uganda; Evans (13) in South Africa, especially on kafirs; McAlpine (24) in Australia; Hauman and Parodi (15) in Argentina. It has also been recorded in lists of smuts collected in different parts of Europe: by Winter (34) in Germany, Schröter (29) in Silesia, Lind (21) in Denmark, Lindau (22) in the Mark Brandenburg, Bubák (7) in Bohemia, Príllieux (28) in France, and Passerini (26) in Italy. The first record of its occurrence in the United States was made by Burrill (8) in 1888. It was reported by Webber (33) in Nebraska in 1889, and by Failyer and Willard (14) in Kansas in 1890. In 1906 Clinton (12) recorded its occurrence in thirteen states, as well as in Ontario, Canada, Jamaica, and Cuba.

Sphacelotheca cruenta was first described by Kühn (17) in 1872. It has been recorded by Winter (34) in Germany; Schröter (29) in Silesia; Bubák (7) in Bohemia; Busse (9) in Tanganyika Territory; Kulkarni (19) in the Sholapur District of the Bombay Presidency; and Butler (10) in the Central Provinces. It was first collected in the United States by Trelease (32) at Madison, Wisc., who, however, incorrectly recorded it as *Sphacelotheca Sorghi*. According to Potter (27) it has been introduced into the United States on seeds of kaoliangs from various parts of China. Its presence in Australia or South Africa has not been noted.

According to the investigations of Kühn (18), Brefeld (3, 4, 5), Clinton (11), Kellerman (16), Butler (10), Kulkarni (19), and others, the two kernel-smuts have a very similar life-history. The infection takes place in the early germination stages of the seedlings and usually from spores adhering to the seed. After penetration of the germ-tube, the young mycelium develops in the embryonic tissue of the host, keeping pace with the latter's development. At the flowering period the ovaries and adjacent parts of the host are converted into the characteristic smut balls. The pathological differences between the two smuts are quite striking and are described below. The spores, however, are very similar in shape and size and germinate in a similar fashion.

The seed of the varieties of sorghum was obtained from a number of different sources. Some of it was secured from seedsmen, but many of the samples were obtained from the Agricultural Experiment Stations of Missouri, Louisiana, Kansas, Oklahoma, and Texas. The writer is especially indebted to Dr. C. R. Ball and Mr. B. E. Rothgeb, Office of Cereal Investigations, and Mr. H. N. Vinall, Office of Forage Crop Investigations, U. S. Department of Agriculture, for the seed of a large number of varieties.

The spores of *Sphacelotheca Sorghi* used for inoculation were collected on kafir, grown in experimental work the previous season. The spores of *Sphacelotheca cruenta* were obtained through the courtesy of Mr. S. L. Ajreker, Poona Agricultural College, Poona, India.

Sufficient seed for planting the rows was placed in separate packets and one set of the varieties was inoculated by dusting heavily with the spores of *Sphacelotheca Sorghi*, and the other set inoculated in the same fashion with the spores of *S. cruenta*. Special care was taken not to mix the two smuts either during the operation of inoculation or subsequent planting. Due to poor germination of the seed only a few plants of some strains or varieties were obtained. In most cases, however, a fair number of plants grew to maturity.

DISCUSSION AND COMPARISON OF RESULTS

As will be noted from an examination of the table, varieties belonging to all the seven main groups of sorghum (broom corn,

VARIETAL RESISTANCE OF SORGHUMS TO SPHACELOTHECA SORGHI (LINK) CLINTON AND SPHACELOTHECA CRUENTA (KÜHN) POTTER

Variety	Seed No.	*Sphacelotheca Sorghi*			*Sphacelotheca cruenta*						
								Comparison of Plants [3]			
								Normal		Infected	
		No. Plants	No. Inf.	Per Cent Inf.	No. Plants	No. Inf.	Per Cent Inf.	No.	Height	No.	Height
Broomcorn, Acme	*180* (*C.I. 243*)	22	6	27.2	26	3	11.5	1	3′–10″	1	3′– 0″
" Standard	*199*	45	4	8.8	35	2	5.8	3	8′– 3″	2	4′– 5″
Durra, Brown	*30*	—	—	—	23	10	43.4	5	6′– 3″	10	5′– 3″
" "	*74*	36	12	33.3	—	—	—	—	—	—	—
Darso	*49*	20	0	0	—	—	—	—	—	—	—
"	*165*	39	0	0	25	6	24.0	10	4′– 4″	6	3′– 9″
"	*225* (*Tex. Sta. 2897*)	22	0	0	20	13	65.0	7	3′–11″	13	3′– 3″
"	*234* (*C.I. 615*)	23	0	0	—	—	—	—	—	—	—
Feterita	*182* (*C.I. 182*)	39	0	0	—	—	—	—	—	—	—
"	*232* (*F.C.I. 2157*)	30	0	0	39	0	0	—	—	—	—
" , Spur	*151* (*Tex. Sta. 3232*)	9	0	0	—	—	—	—	—	—	—
" "	*183* (*C.I. 623*)	37	0	0	36	0	0	—	—	—	—
" "	*226* (*Tex. Sta. 3232*)	10	0	0	15	0	0	—	—	—	—
Hegari, Dwarf	*84*	9	0	0	6	0	0	—	—	—	—
" "	*148* (*S.P.I. 34911*)	5	0	0	—	—	—	—	—	—	—
Kafir, Blackhull	*153* (*F.C.I. 2036*)	3	3	100	—	—	—	—	—	—	—
" "	*184* (*C.I. 204*)	20	8	40	23	5	21.7	11	3′– 4″	5	2′– 4″
" "	*185* (*C.I. 71*)	40	12	30	47	9	19.1	14	4′– 5″	9	4′– 0″
" "	*223* (*F.C.I. 2165*)[4]	67	20	29.8	85	12	14.1	19	4′– 9″	11	4′– 0″
" "	*223* " "[5]	172	73	42.4	113	39	34.5	61	3′– 0″	39	2′– 1″
" "	*227* (*Tex. Sta. 6022*)	37	8	21.6	37	5	13.5	5	4′– 2″	5	4′– 3″
" Dawn	*154* (*F.C.I. 1932*)	22	4	18.1	—	—	—	—	—	—	—
" "	*186* (*C.I. 340*)	37	16	43.2	47	13	27.6	23	3′–10″	9	3′– 1″
" "	*228* (*Tex. Sta. 673*)	6	3	50.0	24	5	20.8	15	3′– 0″	5	3′– 5″
" Pink	*155* (*F.C.I. 1930*)	26	9	34.6	17	5	20.4	7	4′– 7″	5	3′– 8″
" " (Late)	*156* (*F.C.I. 9439*)	12	1	8.3	—	—	—	—	—	—	—

[3] For various reasons not all of the plants in the rows were measured.

Variety	Seed No.	*Sphacelotheca Sorghi*			*Sphacelotheca cruenta*						
								Comparison of Plants[a]			
								Normal		Infected	
		No. Plants	No. Inf.	Per Cent Inf.	No. Plants	No. Inf.	Per Cent Inf.	No.	Height	No.	Height
" Red	*157 (S.P.I. 19749)*	10	0	0	19	10	52.6	6	4′– 1″	10	3′– 3″
" "	*188 (C.I. 34)*	27	2	7.4	32	10	31.2	10	4′– 7″	10	3′–11″
" "	*229 (Tex. Sta. 46)*	18	2	11.1	12	1	8.3	—	—	—	—
" Sunrise	*189 (C.I. 472)*	45	10	22.2	38	6	15.7	11	6′– 6″	6	5′– 2″
Kafirita	*235 (C.I. 548)*	34	0	0	—	—	—	—	—	—	—
Kaoliang, Barchet	*190 (C.I. 310)*	27	0	0	19	1	5.2	11	5′– 6″	1	5′–10″
" Brown	*158 (S.P.I. 38463)*	12	0	0	—	—	—	—	—	—	—
" Dwarf	*121 (C.I. 293)*	33	0	0	31	0	0	—	—	—	—
" Manchu	*119 (C.I. 328–1)*	33	1	3.3	—	—	—	—	—	—	—
" "	*191 (C.I. 171)*	37	7	18.9	33	9	27.2	13	7′–11″	9	5′– 4″
" Valley	*192 (C.I. 309)*	34	13	38.2	32	6	18.7	18	7′– 0″	5	4′– 9″
Milo, Dwarf	*159 (F.C.I. 1933)*	6	0	0	—	—	—	—	—	—	—
" "	*193 (F.C.I. 332)*	38	0	0	33	0	0	—	—	—	—
" "	*224 (F.C.I. 2158)*	27	0	0	32	0	0	—	—	—	—
" "	*231 (Tex. Sta. 670)*	29	0	0	34	0	0	—	—	—	—
" Standard	*194 (C.I. 234)*	28	0	0	—	—	—	—	—	—	—
" White	*160 (F.C.I. 5886)*	21	0	0	16	0	0	—	—	—	—
" Dwarf White	*205*	25	0	0	18	0	0	—	—	—	—
Shailu	*161 (Agrost. 2650)*	4	1	25.0	18	10	55.5	7	5′–11″	10	4′– 5″
"	*230 (Tex. Sta. 1653)*	34	2	5.8	42	2	4.7	—	—	—	—
Sorgo, Black Amber	*162 (F.C.I. 7038)*	34	7	20.5	47	8	17.0	9	7′– 5″	8	5′– 8″
" Gooseneck	*233 (Agrost. 2652)*	21	5	23.8	21	3	14.2	—	—	—	—
" Orange	*135 (C. I. 113a)*	27	10	37.0	17	7	41.1	6	7′– 1″	7	5′– 3″
" "	*169 (F.C.I. 2025)*	14	4	28.5	12	0	0	—	—	—	—
" Red Amber	*232 (S.P.I. 17548)*[4]	31	9	29.0	36	7	19.4	7	6′– 7″	5	5′– 7″
" " "	*232 (" 17548)*[5]	31	12	38.7	39	12	30.7	—	—	—	—
" Sumac	*139 (F.C.I. 1831)*	64	26	40.6	110	19	17.2	29	6′– 6″	11	5′– 0″
Sudan Corn	*197*	21	0	0	—	—	—	—	—	—	—

[4] Planted May 23.
[5] Planted July 12.

durra, kafir, kaoliang, milo-feterita, shallu, and sorgo) were inoculated with *Sphacelotheca Sorghi*. In addition, certain sorghums, whose exact classification has not been determined, such as darso, hegari, and kafirita, were grown. Several of the strains were not included in the series with *S. cruenta*, but practically all of the varieties were represented.

The results with *Sphacelotheca Sorghi* correspond very closely to those obtained previously. The varieties of broom corn, durra, kafir, shallu, and sorgo proved to be quite susceptible. As a rule, however, the percentages of infection were not so high as those secured in previous years. In a few cases negative results were obtained with varieties or strains which in the past have been readily infected. On the other hand, darso, feterita, kafirita, milo, and Sudan corn have proved to be entirely free from infection, results in harmony with those previously obtained. Comparatively low percentages of infection, or even negative results, were secured with several kaoliangs—Barchet, Brown, and Manchu (*119*). On the other hand, Manchu (*191*) and Valley kaoliang gave relatively high percentages of infection. Dwarf kaoliang remained entirely free from infection as in previous years.

The results with *Sphacelotheca cruenta* show a close correspondence with those obtained with *S. Sorghi*. With the loose kernel-smut, positive results were obtained with the varieties and strains of broom corn, kafir, durra, shallu, and sorgo. Negative results were secured with feterita, milo, Dwarf hegari, and Dwarf kaoliang. The other kaoliangs grown were infected. Usually somewhat lower percentages of infection were obtained than with *S. Sorghi*. Higher percentages, however, were secured with Brown durra, Red kafir (*157* and *188*), Barchet kaoliang, Manchu kaoliang (*191*), and Shallu (*161*).

The most striking difference between the infecting capacities of the two smuts occurred in the case of darso. Four strains of this sorghum were grown in the series with *Sphacelotheca Sorghi*. Out of a total of 104 plants, none were infected. In previous years darso has also consistently shown freedom from infection with this smut. On the other hand, two of these strains were grown in the series with *S. cruenta*, and both gave a considerable

number of infected plants. Out of a total of 45 plants of both strains, 19 were infected.

The results with Dwarf milo differ entirely from those obtained by Kulkarni (20). As already noted, he states that he secured fifty infected heads out of a total of 645, a percentage of infection of 7.8 per cent. In the course of the present experiments, 99 plants of Dwarf milo belonging to three different strains were grown and none of them were infected.

DIFFERENCES IN THE PATHOLOGICAL EFFECTS OF THE TWO KERNEL-SMUTS OF SORGHUM

Sphacelotheca Sorghi and *S. cruenta* produce quite different effects on the host plants, which may be compared as follows:

1. One of the most obvious differences observed was in the date of emergence of the heads of normal and infected plants. Plants infected with *Sphacelotheca Sorghi* headed out at the same time as normal plants. On the other hand, plants infected with *S. cruenta* headed out very much earlier than the noninfected plants. Practically all of the heads of the smutted plants had fully emerged before any normal heads appeared in the row. Brefeld (3, 4) first called attention to this fact in connection with his experiments with this smut.

2. There was no difference observed in the height of plants infected with *Sphacelotheca Sorghi* as compared with the normal plants. In one or two cases exact measurements were made, but no differences were found. Certainly, as one observed the rows of plants, the infected plants were fully as tall as the normal.

In the case of *Sphacelotheca cruenta* the difference was very striking. Almost invariably the infected plants were 6 inches to a foot or more shorter than the normal. In the table the measurements of both normal and infected plants are given. Normal plants of durra average a foot taller than the infected plants, normal plants of darso 6″–8″ taller, normal plants of the various kafirs 6″–12″ taller, normal plants of kaoliangs 2 feet or more taller, normal plants of shallu 1½ feet taller, normal plants of sorgos 1–2 feet or more taller. In only a few cases did the infected plants average as tall or taller than the normal.

3. In general appearance, the plants infected with *Sphacelotheca Sorghi* resembled the normal plants. On the other hand, plants infected with *S. cruenta* showed a marked tillering and branching. In many cases an unusual number of tillers originated at the ground level, and there was also an increased development of side branches on the main stem. Consequently, young, smutted heads appeared from lateral branches during the growing season. There was, of course, some branching in the case of plants infected with *S. Sorghi,* but this did not seem to differ in any way from the normal plants.

4. Plants infected with *Sphacelotheca cruenta* sometimes showed a marked enlargement of the glumes. This was particularly the case in the Brown durra. On the other hand, *S. Sorghi* does not seem to produce any change of this character in any variety of sorghum. (See pl. 14, figs. 1 and 9.)

5. The heads infected with *Sphacelotheca Sorghi* are compact and about the same size as the normal, or even larger, due to the increased size of the smut balls as compared with the normal kernels. On the other hand, heads infected with *S. cruenta* are much more slender, with a somewhat looser arrangement than in the case of normal heads. (Compare pl. 14, figs. 1 and 2, and pl. 15, figs. 11 and 12.)

6. The sori of *Sphacelotheca Sorghi* are confined to the flowers. The ovary is converted into the enlarged smut balls. *S. cruenta,* however, may produce sori on the pedicels or other parts of the panicle as well as in the flowers. This has been emphasized as one of the characteristic features of this smut. During the past season, however, a single head of Red Amber sorgo, out of many hundreds of heads observed, showed sori on the pedicels or branches of the panicle.

7. The smut balls of *Sphacelotheca Sorghi* are more or less conic and possess a comparatively thick, tough membrane, which persists for a considerable period and which stands a great deal of weathering. The smut balls of *S. cruenta* are much longer, more slender, and cylindric in shape. They also break open very readily and permit the distribution of the spores. This rupturing of the membrane occurs even before the smut ball has completely emerged

from the glumes. The membrane is light-grayish in color and is very thin and delicate. It is composed of nearly spheric cells, which are much larger than the spores and which readily separate from each other. The cells of the membrane of *S. Sorghi* are smaller, somewhat elongated, and adhere together. (Compare pls. 14 and 15.)

8. The central columellae of the smut balls of *Sphacelotheca cruenta* are much longer, more slender, and curved than those of *S. Sorghi.* Due to the early dissemination of the spores in the field they are quite conspicuous on the maturing plants. (Pl. 14.)

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BROOKLYN BOTANIC GARDEN.

EXPLANATION OF PLATES

PLATE 14

Fig. 1. *Sphacelotheca cruenta.* Infected head of Brown durra. Smut balls emerging between enlarged glumes. 4/5 nat. size.

Fig. 2. *S. cruenta.* Infected head of Brown durra. Late stage, spores largely disseminated and columellae visible. 4/5 nat. size.

SPHACELOTHECA CRUENTA (KÜHN) POTTER

Sphacelotheca Sorghi (Link) Clinton

Fig. 3, 4. *S. cruenta.* Darso, early and late stages. 4/5 nat. size.

Fig. 5, 6. *S. cruenta.* Black Amber sorgo, early and late stages. 4/5 nat. size.

Fig. 7, 8. *S. cruenta.* Shallu, early and late stages. 4/5 nat. size.

Fig. 9, 10. *S. cruenta.* Brown durra, early and late stages. 4/5 nat. size.

PLATE 15

Fig. 11. *S. Sorghi.* Infected head of Brown durra. 1/2 nat. size.

Fig. 12. *S. Sorghi.* Normal head of Brown durra. 1/2 nat. size.

Fig. 13. *S. Sorghi.* Branch of infected head of Brown durra. 2/3 nat. size.

Fig. 14. *S. Sorghi.* Branch of normal head of Brown durra. 2/3 nat. size.

Fig. 15. *S. Sorghi.* Branch of infected head of Dawn Kafir. 2/3 nat. size.

Fig. 16. *S. Sorghi.* Branch of normal head of Dawn Kafir. 2/3 nat. size.

NOTES AND BRIEF ARTICLES

(Unsigned notes are by the editor)

A bibliography of fungous insects and their hosts, compiled from American literature by H. B. Weiss, appeared in *Entomological News* **32**: 45–47. 1921.

Mosaic diseases are discussed at length by B. T. Dickson in Technical Bulletin 2 of Macdonald College, which contains over 100 pages of text, an extensive bibliography, and several plates of illustrations.

An article on phosphorescent woods, by D. Bois, appeared in *Jour. Soc. Nat. Hort. France* **21**: 392–395. 1920. The various fungi causing phosphorescence (luminescence) are there discussed and their distribution given.

In a recent paper in the *Transactions of the British Mycological Society*, Professor Buller describes and discusses the basidial and oidial fruit-bodies of *Dacryomyces deliquescens*, the oidial stage of which has been generally known as *Dacryomyces stillatus* Nees.

In an article by A. S. Rhoads in *Phytopathology* for October, 1921, *Collybia velutipes* and *Pleurotus ostreatus* are reported as serious wound-parasites on *Lupinus arboreus* in California; infection being largely due to tunnels made in the stems of this shrub by the larvae of a moth.

A long and abundantly illustrated paper by F. L. Stevens on the Helminthosporium foot-rot of wheat, with observations on the morphology of this genus of fungi and the occurrence of saltation in it, appeared in the *Bulletin of the Illinois Natural History Survey* for June, 1922.

An unknown disease of elms in Holland has been causing much damage to practically all the species and varieties of this tree used on city streets. Several fungi have been isolated, but no organism has been definitely connected as yet with the disease and no control measures have been suggested.

A new fungous enemy of the pepper tree, grown extensively in the Southwest for ornament, was recently described by J. G. Brown in *Science* as *Inonotus Schini*. This fungus enters through cracks and wounds made by frost, wind, and improper pruning. It causes decay in the trunk and finally kills the tree.

Ringworm of the nails in the southern United States is reported by R. S. Hodges to be due to a small-spored ectothrix (a species of *Trichophyton*) and to *Trichophyton rubrum*. About 1 in every 500 of the population there have this disease, which seems to appear first in the form of eruptions on the hands and feet.

According to C. D. Girola, considerable damage is done to fruit and forest trees in the Argentine by *Ganoderma sessile*, which is distributed by the spores gaining access to wounds or by the mycelium spreading from diseased to healthy roots. Several recommendations are made regarding the best methods of controlling this disease.

A number of avocado diseases are discussed by H. E. Stevens in *Fla. Sta. Bull.* 161: 3-23. 1922, and recommendations made for controlling them. Bordeaux mixture is said to be effective in the case of scab (*Cladosporium*), black spot (*Colletotrichum*), blotch (*Cercospora*), and rusty blight (*Gloeosporium*), but lime-sulphur solution is suggested for the powdery mildew (*Oïdium*).

In response to requests for specimens of myxomycetes found in the Cayuga Lake Basin, F. B. Wann and W. C. Muenscher have begun to issue ten sets of "North American myxomycetes," distributed among herbaria at Washington, Cincinnati, Albany, Pitts-

burgh, Madison, Ithaca, Toronto, Cambridge, Berkeley, and London (England). A list of the fifty species in the first set appeared in *Mycologia* for January, 1922.

I have before me two recent bulletins on wildfire of tobacco, one from the Connecticut Experiment Station by Clinton and McCormick and the other from the North Carolina Experiment Station by Wolf. Also a bulletin on blackfire, or angular leaf-spot of tobacco, by Fromme and Wingard, of the Virginia Experiment Station. This latter disease is caused by *Bacterium angulatum*, an organism described by Fromme and Murray in 1919.

A foot-rot of rhubarb caused by a variety of *Phytophthora parasitica* is described, discussed, and abundantly illustrated in an article by G. H. Godfrey in the *Journal of Agricultural Research* for Jan. 6, 1923. This disease has been found in Maryland and Virginia, and is probably much more widely distributed. It rapidly and completely destroys its host, especially in warm, moist weather; but may be controlled to a degree by the use of Bordeaux combined with careful sanitary measures.

A valuable professional paper by N. O. Howard on the control of sap-stain, mold, and incipient decay in green wood appeared toward the end of 1922 as Bulletin 1037 of the U. S. Dept. of Agriculture. It contains over 50 pages of text, many text-figures, and a long bibliography. Care in the selection of raw stock, quick drying, ample ventilation, and steam treatment or antiseptic dips in special cases are recommended as preventive measures. Neither molds nor staining fungi appear to affect the strength of timber.

The white heart-rot of black locust, caused by *Trametes robiniophila*, is the subject of a paper contributed by Kauffman and Kerber to the *American Journal of Botany* for November, 1922. This article, which raises more questions than it answers and may therefore stimulate further research, includes a discussion of the macroscopic and microscopic characteristics of the rot, its mode of

advance, the distribution of the mycelium in the various portions of the affected trunk, and its effect on the various elements of the wood.

The germination and growth of fungi at various temperatures and in various concentrations of oxygen and of carbon dioxide is discussed by W. Brown in the *Annals of Botany* **36**: 257–283. 1922. The author concludes, on the basis of various investigations, that the gas storage method is most effectively used in combination with the ordinary cold storage method, and that it will give the best results when no attack of the fruit has begun previous to storage, and when conditions are such that a minimum of nutrient is available for spores on the surface of the fruit.

The development of the Geoglossaceae is discussed at length in a valuable illustrated paper by G. H. Duff in the *Botanical Gazette* for November, 1922. A very close correspondence appears to exist in the history of the fertile systems of the Geoglossaceae and of certain disco-lichens of the *Baeomyces* group, which, in addition to the Helvellinean veil, seems good evidence of relationship. The progress of evolution in these plants, according to the author, has been from a type in which fertilization took place through the agency of the trichogyne, and has been marked by a gradual reduction of the sex organs.

Observations on two poplar cankers in Ontario, by E. H. Moss, appeared in *Phytopathology* for September, 1922. *Cytospora chrysosperma* and *Dothichiza populea* are said to occur rather commonly in southern Ontario, and, according to the author, the latter disease has existed on this continent for a considerable period of time. Older trees of certain species of *Populus* commonly planted are rendered unsightly and are gradually killed by these two fungi. Younger trees of *P. deltoides*, especially if seriously injured or weakened, are likely to succumb to the attacks of *C. chrysosperma*, and infected nursery stock of *P. italica* is rapidly killed by *D. populea*.

In Spaulding's recent monograph on the white pine blister rust, the Asiatic origin of this very important disease seems to be established, with a number of interesting facts regarding its life-history. The aeciospores from the overwintered mycelium in the pine bark are the chief source of infection, these spores being capable of attacking leaves of *Ribes* after having been blown several miles. The uredospores perish much more quickly, while the sporidia can carry infection only 100 to 600 yards. Unfortunately, this rust has appeared in the great pine forests of the Northwest, where the valuable stands of *Pinus monticola* and *P. Lambertiana* are now directly threatened.

The effect of external and internal factors on the germination of fungous spores has been studied by W. L. Doran, who contributed an article on the subject to the *Torrey Bulletin* for November, 1922. After experimenting with a number of species, the author concluded that the spores of parasite fungi germinate better when obtained from the living host than when obtained from artificial media; that freshly matured spores can germinate through a broader range of environmental conditions than can old spores; and that longevity of spores is dependent on conditions of storage after detachment from the host, moisture being of more importance than temperature.

The North American species of *Clavaria* are treated by Burt in his usual excellent style in the *Annals of the Missouri Botanical Garden* for February, 1922, which appeared in August. Ninety-eight species are included, many of them being figured on the eleven closely crowded plates. Species described as new are: *Clavaria pinicola*, from Idaho; *C. flavuloides*, from New York, known by Peck as *C. subtilis* Pers.; *C. mutans*, from New York, known by Peck as *C. Krombholzii;* and *C. pilosa*, from Porto Rico. The following species are excluded from the genus: *C. ornatipes*, *C. subcorticalis*, and *C. vestipes*, transferred to *Lachnocladium;* *C. tenax* to *Tremellodendron;* and *C. typhuloides* to *Pistillaria*. A few exotic species are also discussed.

A brief paper on the mycorhizas of coniferous trees, by W. B. McDougall, appeared in the *Journal of Forestry* for March, 1922. The specimens on which this paper was based were collected by Mr. Barrington Moore at Bar Harbor, Maine, in October, 1921, and forwarded at once in a fresh condition to the author, who made several interesting notes upon them. In his conclusion, he says: "It was formerly believed that the ectotrophic mycorhizal fungi were of considerable benefit to the host plants in that they aided them in absorbing materials from the soil and this old idea is still retained in many, even of the latest, botanical text-books. There is no evidence in favor of such a hypothesis, however, and it is the consensus of opinion among recent workers on these structures that the fungi are merely parasitic on the roots of the higher plants, and that the higher plants receive no benefit at all from the association."

Citrus scab is the subject of a professional paper by J. R. Winston, published on Jan. 26, 1923, as Bulletin 1118 of the U. S. Dept. of Agriculture. This widely distributed citrus disease of foreign introduction is, according to the author, second in importance to melanose and stem-end rot caused by *Phomopsis Citri.* It is considered the most serious fungous disease of the citrus nursery, where it attacks leaves and succulent twigs. In the orchard its activity is mainly confined to fruit and leaves. Young grapefruits are extremely susceptible to infection immediately after the falling of the petals, but they become progressively resistant until they reach immunity at a diameter of about three fourths of an inch. Citrus scab is caused by a definite fungus, usually but erroneously referred to as *Cladosporium Citri* Massee, although it has none of the characters of *Cladosporium* Link. Plain Bordeaux mixture as well as Bordeaux with oil emulsion is very effective against this disease, either in the nursery or in the orchard.

Professor Fitzpatrick went to Minneapolis early in the year and attended to the shipment of the Durand library and herbarium to Cornell University. In reply to a query regarding this immensely important collection, he wrote me under date of Feb. 22 as follows:

"This collection has now reached us safely, though as yet it has not been unpacked. It includes 12,000 specimens of discomycetes and 6,000 carefully prepared slides, many of which represent mounts made from type specimens by Durand in various institutions of this country and abroad. The specimens are completely indexed and are accompanied by Dr. Durand's personal notes on them. The collection was obtained in the cases and will be retained as a unit in the shape in which Dr. Durand left it. The library contains about 200 books chiefly on discomycetes and about 5,000 separates. This herbarium and the Atkinson herbarium will be housed in the plant pathology department, but will be kept as units, and will not be added to as the years pass. The plant pathology herbarium here will be the growing herbarium."

Sullivant's Ohio Fungi

A number of the fungi collected in the vicinity of Columbus, Ohio, by Sullivant and sent to Montagne in Paris for study have not been identified by American collectors since Sullivant's time. In publishing my recent papers on dark-spored agarics, a few notes made at Paris in 1913 escaped my attention. They are of no great value without further comparison of specimens, but may help some student who has the opportunity to work with fresh plants in the region where Sullivant collected. The notes are given as I made them at the time.

Agaricus (Hypholoma) comaropsis Mont. Syll. Crypt. 122. 1856. Very young, small, conic, with long stipe, growing in loam. Might be some young *Hypholoma*, but entirely unrecognizable.

Agaricus foederatus Berk. & Mont. Syll. Crypt. 121. 1856. Columbus, Ohio, *Sullivant 87*. Cespitose in moss and soil, but probably from buried wood. It is a species of *Hypholoma* and what else but *H. lacrymabundum* or *H. perplexum*? The spores must be compared, however. It seems less firm than *H. perplexum*, but the specimens are old. I did not find it at Kew.

Agaricus (Psathrya) pholidotus Mont. Syll. Crypt. 126. 1856. Columbus, Ohio, *Sullivant 29*. This is in shape for comparison. It is similar to *Hypholoma Candolleanum* and *H. pelianthum*, according to Montagne, but the spores are bay-fuscous.

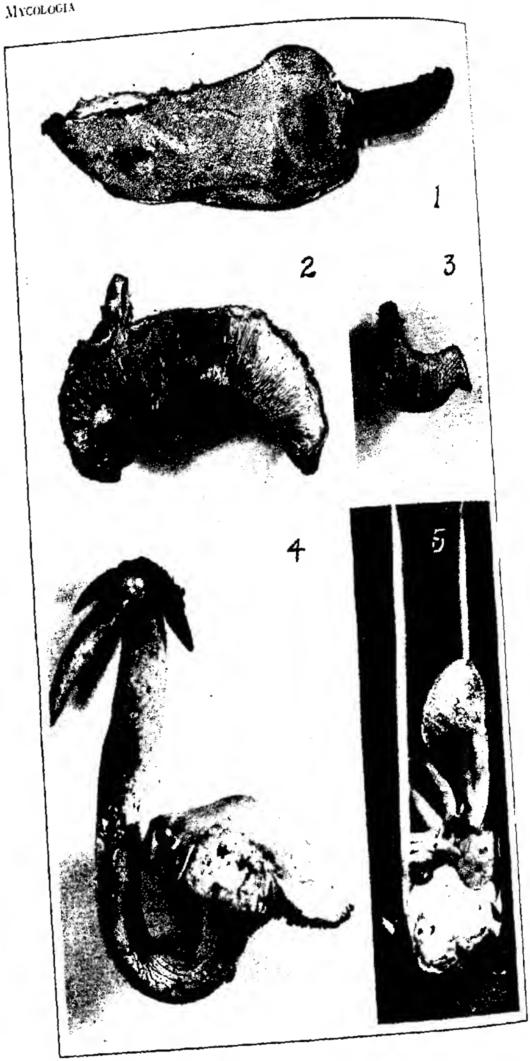
Agaricus falcifolius Mont. Syll. Crypt. 127. 1856. Columbus, Ohio. *Sullivant 9.* Lots of it in clusters on bark, well preserved. About the shape of *Coprinus micaceus,* but without glistening scales. Placed by Saccardo in *Psathyrella.*

Agaricus puliculosus Mont. Syll. Crypt. 124. 1856. Placed in the genus *Psilocybe* by Saccardo. Specimens collected on the ground at Columbus, Ohio, by Sullivant. Types pretty well preserved and can be compared.

Agaricus rhodophaeus Mont. Syll. Crypt. 124. 1856. Collected among fallen leaves at Columbus, Ohio, by Sullivant. Specimens fairly well preserved and can be compared. Saccardo places it in *Psilocybe.*

Agaricus Sullivantii Mont. Syll. Crypt. 123. 1856. On naked ground near Columbus, Ohio, *Sullivant 258.* Apparently *Hypholoma velutinum.* It is large and shaggy with a large stipe. Saccardo places it in *Psilocybe.*

W. A. Murrill



1–3. Trametes serialis
4. Lentinus lepideus
5. Lentinus tigrinus